

Study plan

Name of study plan: Diagnostika materiálů

Faculty/Institute/Others:

Department: Department of Materials

Branch of study guaranteed by the department: Diagnostics of Materials

Garantor of the study branch: prof. Dr. RNDr. Miroslav Karlík

Program of study: Applications of Natural Sciences

Type of study: Follow-up master full-time

Required credits: 105

Elective courses credits: 15

Sum of credits in the plan: 120

Note on the plan:

Name of the block: Compulsory courses of the specialization

Minimal number of credits of the block: 105

The role of the block: PO

Code of the group: NMSDMPP1

Name of the group: NMSDM - povinné předměty 1. ročník

Requirement credits in the group: In this group you have to gain at least 52 credits

Requirement courses in the group: In this group you have to complete at least 13 courses

Credits in the group: 52

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
14AED1	Analysis of Experimental Data 1 Petr Kopřiva Petr Kopřiva (Gar.)	Z,ZK	3	2	1	PO
14AED2	Analysis of Experimental Data 2 Petr Kopřiva Petr Kopřiva (Gar.)	Z,ZK	3	2	2	PO
14DYKO	Dynamics of Continuum Jaromír Horáček Jaromír Horáček (Gar.)	Z,ZK	3	2+0	1	PO
14EXM1	Experimental Methods 1 Petr Jaroš Petr Jaroš (Gar.)	KZ	4	4	1	PO
14EXM2	Experimental Methods 2 Ivan Nedbal, Jan Siegl Ivan Nedbal (Gar.)	KZ	4	4	2	PO
14FYM1	Physical Metallurgy 1 Miroslav Karlík Miroslav Karlík (Gar.)	Z,ZK	6	4	Z	PO
14FYM2	Physical Metallurgy 2 Petr Haušild Petr Haušild (Gar.)	Z,ZK	3	2+0	L	PO
14LME1	Fracture Mechanics 1 Jiří Kunz Jiří Kunz (Gar.)	Z,ZK	3	2+0	1	PO
14LME2	Fracture Mechanics 2 Jiří Kunz Jiří Kunz (Gar.)	Z,ZK	3	2+0	2	PO
14PLAS1	Plasticity 1 Vladislav Oliva Vladislav Oliva (Gar.)	Z,ZK	3	2+0	2	PO
14VUSM1	Research Project 1 Petr Kopřiva Petr Kopřiva (Gar.)	Z	6	0+6	1	PO
14VUSM2	Research Project 2 Petr Kopřiva Petr Kopřiva (Gar.)	KZ	8	0+8	2	PO
14UNMA	Fatigue of Materials Hynek Lauschmann Hynek Lauschmann (Gar.)	KZ	3	2+0	2	PO

Characteristics of the courses of this group of Study Plan: Code=NMSDMPP1 Name=NMSDM - povinné předměty 1. ročník

14AED1	Analysis of Experimental Data 1 The course gives an overview of the probability theory with respect to applications in technical sciences.	Z,ZK	3
14AED2	Analysis of Experimental Data 2 Lectures on mathematical statistics with respect to applications in technical sciences.	Z,ZK	3
14DYKO	Dynamics of Continuum Natural, free, transient and forced vibrations of continuous systems (strings, rods, beams, membranes, plates, shells), equations of motion, method of solution and basic dynamical characteristics.	Z,ZK	3

14EXM1	Experimental Methods 1	KZ	4
There is presented the survey of temporarily applied experimental methods and procedures at following specialties: - experimental analysis of the main mechanical values (stress, displacement, force, moment, pressure etc.), - experimental dynamics (exciters, vibration transducers, damping, balancing, vibroanalysis). Every four-hours lecture consists of theoretical and experimental parts in 1 : 1 time ratio. The actual topics is immediately fixed by laboratory practice in maximally three students groups organised as research team with the leader who is responsible for the proper fulfilment of the task and home elaboration of the report. Each group is leaded by the teacher to advice and solve an incidental troubles through the work.			
14EXM2	Experimental Methods 2	KZ	4
Basic and accessible methods of experimental examination of materials in microvolume, their application in the study of material properties and in the domain of failure research.			
14FYM1	Physical Metallurgy 1	Z,ZK	6
Basic principles of metal physics, acquired in preceding courses, are extended to the applications in the field of processing and thermo mechanical treatment of different structural materials. Furthermore, an introduction to degradation processes as radiation damage, oxidation and corrosion is given.			
14FYM2	Physical Metallurgy 2	Z,ZK	3
The course is based on previously acquired general physical and physical metallurgical knowledge and applies this knowledge to real systems such as Fe-C and Fe-X-C, multicomponent Fe and Ni -based alloys, etc., which are the basis of steels and special structural materials. Since the Physical Metallurgy 2 builds on the previous, more theoretically oriented courses of Metal Physics and Physical Metallurgy 1, added emphasis is placed on applications of real systems in engineering.			
14LME1	Fracture Mechanics 1	Z,ZK	3
Mechanisms and modes of fracture. Stress and strain field in the vicinity of notch or crack tip. Parameters of linear elastic fracture mechanics. Total energy balance approach. Fracture toughness of materials and crack stability examination. Application in research and engineering practice.			
14LME2	Fracture Mechanics 2	Z,ZK	3
Parameters of non-linear elastic-plastic fracture mechanics. Fracture toughness of structural alloys in the case of general yielding. Fatigue of materials - fundamentals, fatigue crack propagation under various conditions, application of fracture mechanics. Case studies.			
14PLAS1	Plasticity 1	Z,ZK	3
The course represents an introduction to plasticity in terms of continuum mechanics. The first part contains a general incremental theory: yield criteria, strain hardening, criterion for local loading and unloading, plastic potential, flow rule and corresponding physical equations. The second part represents a logical descent to the practical engineering solution of simple problems on elastic-plastic tension, bending, torsion and plastic collapse of bars and beams.			
14VUSM1	Research Project 1	Z	6
Abstract: The research project is based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the project supervisor during common regular meetings and discussions.			
14VUSM2	Research Project 2	KZ	8
Abstract: The research project is based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the project supervisor during common regular meetings and discussions.			
14UNMA	Fatigue of Materials	KZ	3
Lectures are concerned with explanation of conditions, causes and mechanisms of fatigue damage, as well as material fatigue characteristics, diagrams, equations and computational algorithms.			

Code of the group: NMSDMPP2

Name of the group: NMSDM - povinné předměty 2. ročník

Requirement credits in the group: In this group you have to gain at least 53 credits

Requirement courses in the group: In this group you have to complete at least 9 courses

Credits in the group: 53

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) Tutors, authors and guarantors (gar.)	Completion	Credits	Scope	Semester	Role
14DPSM1	Diploma Thesis 1 Vladislav Oliva Vladislav Oliva (Gar.)	Z	10	0+10	3	PO
14DPSM2	Diploma Thesis 2 Vladislav Oliva Vladislav Oliva (Gar.)	Z	20	0+20	4	PO
14NEDI	Nondestructive Diagnostics Zdeněk Převorovský Zdeněk Převorovský (Gar.)	Z	3	2	3	PO
14NEKO	Non-metallic Materials Miroslav Karlík Miroslav Karlík (Gar.)	Z,ZK	3	2+0	3	PO
14PLAS2	Plasticity 2 Vladislav Oliva Vladislav Oliva (Gar.)	Z,ZK	4	2+0	3	PO
14PMKP	Practicum in Finite Elements Methods Aleš Materna Aleš Materna (Gar.)	KZ	3	0+2	3	PO
14PRAXE	Pre-diploma Practice Vladislav Oliva Vladislav Oliva (Gar.)	Z	4			PO
14TSPO	Theory of Reliability Petr Kopřiva Petr Kopřiva (Gar.)	Z,ZK	3	2+0	3	PO
11VDM	Intrinsic Dynamics of Materials Hanus Seiner Hanuš Seiner Hanuš Seiner (Gar.)	ZK	3	2+0	Z	PO

Characteristics of the courses of this group of Study Plan: Code=NMSDMPP2 Name=NMSDM - povinné předměty 2. ročník

14DPSM1	Diploma Thesis 1	Z	10
Abstract: The diploma project is based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the project supervisor during common regular meetings and discussions.			
14DPSM2	Diploma Thesis 2	Z	20
Abstract: The diploma project is based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the project supervisor during common regular meetings and discussions.			

14NEDI	Nondestructive Diagnostics	Z	3
The course is devoted to acquaintance with theoretical and practical grounding and applications of nondestructive testing (NDT), evaluation (NDE), and inspection (NDI, SHM) of materials and structures. Besides the standard NDT methods, the lectures also deal with the newest NDT/NDE procedures (acoustic emission, nonlinear ultrasonic spectroscopy and tomography, etc.). The education is completed by practical laboratory training in selected methods and also by excursions into industrial companies working on NDT/NDE.			
14NEKO	Non-metallic Materials	Z,ZK	3
This course explains the structure and basic properties of important non-metallic materials, such as ceramics, glass, polymers and composites. These materials can be used as single material for construction, they can form protective coatings or they may be used as components for the functionally graded materials.			
14PLAS2	Plasticity 2	Z,ZK	4
The course deals with an advanced applied plasticity - stress concentration in a plastic zone in front of a notch or a crack, limit theorems and their application in a the notch effect evaluation or in calculation of limit load of structural parts, response of an elastic-plastic body to the cyclic loading, plastic instability and a ductile fracture. The emphasis is made especially on methods and results relevant to material sciences applications.			
14PMKP	Practicum in Finite Elements Methods	KZ	3
Abstract: Use of commercial finite element code for solving practical problems in mechanics.			
14PRAXE	Pre-diploma Practice	Z	4
14TSPO	Theory of Reliability	Z,ZK	3
Lectures on fundamentals of the theory of reliability including basic methodological procedures.			
11VDM	Intrinsic Dynamics of Materials	ZK	3
The course gives an introductory overview of dynamical phenomena taking place in the materials, with the main focus laid on the elastic wave propagation (and its interaction with the microstructure), dynamic plasticity, phase transition fronts kinetics, and dynamic fracture mechanics.			

Name of the block: Elective courses

Minimal number of credits of the block: 0

The role of the block: V

Code of the group: NMSDMVP

Name of the group: NMSDM - volitelné předměty

Requirement credits in the group:

Requirement courses in the group:

Credits in the group: 0

Note on the group:

Code	Name of the course / Name of the group of courses (in case of groups of courses the list of codes of their members) <i>Tutors, authors and guarantors (gar.)</i>	Completion	Credits	Scope	Semester	Role
14EME2	Elasticity 2 <i>Vladislav Oliva, Aleš Materna Vladislav Oliva (Gar.)</i>	Z,ZK	6	4	1	v
14FAP	Fractography and Failure Analysis <i>Jan Siegl Jan Siegl (Gar.)</i>	Z	3	2+0	4	v
14PME	Computational Mechanics <i>Miloslav Okrouhlik Miloslav Okrouhlik (Gar.)</i>	KZ	4	3	2	v
14SEM	Seminar <i>Jan Siegl Jan Siegl (Gar.)</i>	Z	8	0+4	4	v
01VAMB	Variational Methods B <i>Michal Beneš Michal Beneš (Gar.)</i>	KZ	2	2	Z	v
14VLN	Wave Phenomena in Solids <i>Jan Červ Jan Červ (Gar.)</i>	Z	3	2+0	3	v
01ZPB1	Introduction to Computer Security 1 <i>Petr Vokáč Petr Vokáč Petr Vokáč (Gar.)</i>	Z	2	1+1		v
01ZPB2	Introduction to Computer Security 2 <i>Petr Vokáč Petr Vokáč Petr Vokáč (Gar.)</i>	Z	2	1+1		v

Characteristics of the courses of this group of Study Plan: Code=NMSDMVP Name=NMSDM - volitelné předměty

14EME2	Elasticity 2	Z,ZK	6
The course deals with an advanced theory of elasticity - buckling of long straight columns, torsion of non-circular shafts, various plane stress and plane strain problems, Kirhoff's plates, shells. The emphasis is made on methods and results relevant to general solid mechanics and materials science applications.			
14FAP	Fractography and Failure Analysis	Z	3
Lectures summarise basic methods of fractographic analysis used both in the research of new materials and technologies and in the failure analysis of machines and structures. The first part of lectures deals with historical background of fractography in relation with experimental techniques. The second part deals with detail description of different methodological procedures of fractographic analysis. All methods are illustrated by the help of case studies realised in fractographic laboratory of the Department of Materials. both			
14PME	Computational Mechanics	KZ	4
Problem solving of mechanical tasks in engineering by means of discrete methods, numerical mathematics and computer programming with emphasis to nonlinearities.			
14SEM	Seminar	Z	8
Replenishment and reiteration of knowledge from the main profile subjects. Lectures of prominent specialists from material research			
01VAMB	Variational Methods B	KZ	2
The course is devoted to the methods of classical variational calculus - functional extrema by Euler equations, second functional derivative, convexity or monotonicity. Further, it contains investigation of quadratic functional, generalized solution, Sobolev spaces and variational problem for elliptic PDE's.			
14VLN	Wave Phenomena in Solids	Z	3
The course is devoted to wave phenomena in solids. Basic concepts of wave elastodynamics are studied and elucidated in the course. The validity of the linear theory of generally anisotropic continuum is supposed.			

01ZPB1	Introduction to Computer Security 1	Z	2
01ZPB2	Introduction to Computer Security 2	Z	2

List of courses of this pass:

Code	Name of the course	Completion	Credits
01VAMB	Variational Methods B The course is devoted to the methods of classical variational calculus - functional extrema by Euler equations, second functional derivative, convexity or monotonicity. Further, it contains investigation of quadratic functional, generalized solution, Sobolev spaces and variational problem for elliptic PDE's.	KZ	2
01ZPB1	Introduction to Computer Security 1	Z	2
01ZPB2	Introduction to Computer Security 2	Z	2
11VDM	Intrinsic Dynamics of Materials The course gives an introductory overview of dynamical phenomena taking place in the materials, with the main focus laid on the elastic wave propagation (and its interaction with the microstructure), dynamic plasticity, phase transition fronts kinetics, and dynamic fracture mechanics.	ZK	3
14AED1	Analysis of Experimental Data 1 The course gives an overview of the probability theory with respect to applications in technical sciences.	Z,ZK	3
14AED2	Analysis of Experimental Data 2 Lectures on mathematical statistics with respect to applications in technical sciences.	Z,ZK	3
14DPSM1	Diploma Thesis 1 Abstract: The diploma project is based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the project supervisor during common regular meetings and discussions.	Z	10
14DPSM2	Diploma Thesis 2 Abstract: The diploma project is based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the project supervisor during common regular meetings and discussions.	Z	20
14DYKO	Dynamics of Continuum Natural, free, transient and forced vibrations of continuous systems (strings, rods, beams, membranes, plates, shells), equations of motion, method of solution and basic dynamical characteristics.	Z,ZK	3
14EME2	Elasticity 2 The course deals with an advanced theory of elasticity - buckling of long straight columns, torsion of non-circular shafts, various plane stress and plane strain problems, Kirhoff's plates, shells. The emphasis is made on methods and results relevant to general solid mechanics and materials science applications.	Z,ZK	6
14EXM1	Experimental Methods 1 There is presented the survey of temporarily applied experimental methods and procedures at following specialties: - experimental analysis of the main mechanical values (stress, displacement, force, moment, pressure etc.), - experimental dynamics (exciters, vibration transducers, damping, balancing, vibroanalysis). Every four-hours lecture consists of theoretical and experimental parts in 1 : 1 time ratio. The actual topics is immediately fixed by laboratory practice in maximally three students groups organised as research team with the leader who is responsible for the proper fulfilment of the task and home elaboration of the report. Each group is leaded by the teacher to advice and solve an incidental troubles through the work.	KZ	4
14EXM2	Experimental Methods 2 Basic and accessible methods of experimental examination of materials in microvolume, their application in the study of material properties and in the domain of failure research.	KZ	4
14FAP	Fractography and Failure Analysis Lectores summarise basic methods of fractographic analysis used both in the research of new materials and technologies and in the failure analysis of machines and structures. The first part of lectures deals with historical background of fractography in relation with experimental techniques. The second part deals with detail description of different methodological procedures of fractographic analysis. All methods are illustrated by the help of case studies realised in fractographic laboratory of the Department of Materials. both	Z	3
14FYM1	Physical Metallurgy 1 Basic principles of metal physics, acquired in preceding courses, are extended to the applications in the field of processing and thermo mechanical treatment of different structural materials. Furthermore, an introduction to degradation processes as radiation damage, oxidation and corrosion is given.	Z,ZK	6
14FYM2	Physical Metallurgy 2 The course is based on previously acquired general physical and physical metallurgical knowledge and applies this knowledge to real systems such as Fe-C and Fe-X-C, multicomponent Fe and Ni -based alloys, etc., which are the basis of steels and special structural materials. Since the Physical Metallurgy 2 builds on the previous, more theoretically oriented courses of Metal Physics and Physical Metallurgy 1, added emphasis is placed on applications of real systems in engineering.	Z,ZK	3
14LME1	Fracture Mechanics 1 Mechanisms and modes of fracture. Stress and strain field in the vicinity of notch or crack tip. Parameters of linear elastic fracture mechanics. Total energy balance approach. Fracture toughness of materials and crack stability examination. Application in research and engineering practice.	Z,ZK	3
14LME2	Fracture Mechanics 2 Parameters of non-linear elastic-plastic fracture mechanics. Fracture toughness of structural alloys in the case of general yielding. Fatigue of materials - fundamentals, fatigue crack propagation under various conditions, application of fracture mechanics. Case studies.	Z,ZK	3
14NEDI	Nondestructive Diagnostics The course is devoted to acquaintance with theoretical and practical grounding and applications of nondestructive testing (NDT), evaluation (NDE), and inspection (NDI, SHM) of materials and structures. Besides the standard NDT methods, the lectures also deal with the newest NDT/NDE procedures (acoustic emission, nonlinear ultrasonic spectroscopy and tomography, etc.). The education is completed by practical laboratory training in selected methods and also by excursions into industrial companies working on NDT/NDE.	Z	3
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14SEM	Seminar	Z	8
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Lectures on fundamentals of the theory of reliability including basic methodological procedures.			
14UNMA	Fatigue of Materials	KZ	3
Lectures are concerned with explanation of conditions, causes and mechanisms of fatigue damage, as well as material fatigue characteristics, diagrams, equations and computational algorithms.			
14VLN	Wave Phenomena in Solids	Z	3
The course is devoted to wave phenomena in solids. Basic concepts of wave elastodynamics are studied and elucidated in the course. The validity of the linear theory of generally anisotropic continuum is supposed.			
14VUSM1	Research Project 1	Z	6
Abstract: The research project is based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the project supervisor during common regular meetings and discussions.			
14VUSM2	Research Project 2	KZ	8
Abstract: The research project is based on a topic approved by the administrators of the programme, department and by the dean. The student is guided by the project supervisor during common regular meetings and discussions.			

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